AMENDMENTS TO THE CLAIMS

Claims 1-64. (Canceled)

[[1. A method for laser induced breakdown (LIB) of a non-biologic material with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a characteristic laser pulse width, said method comprising the steps of:

a. generating a laser pulse which has a pulse width equal to or less than said characteristic laser pulse width at a fluence to cause a breakdown effect by itself at a wavelength of 800 nanometers to 2 microns; and

b. directing said pulse to a point at or beneath the surface of the material.

2. The method according to claim 1 wherein the material is a metal, the pulse width is 10 to 10,000 femtoseconds, and the pulse has an energy of 1 nanojoule to 1 microjoule.

3. The method according to claim 1 wherein a spot size is varied within a range of 1 to 100 microns by changing the f number of the laser beam.

4. The method according to claim 1 wherein a spot size is varied within a range of 1 to 100 microns by varying the target position.

5. The method according to claim 1 wherein the material is transparent to radiation emitted by the laser and the pulse width is 10 to 10,000 femtoseconds, the pulse has an energy of 10 nanojoules to 1 millijoule.]]

~~6. The method according to claim 1 wherein the material is biological tissue, the pulse width is 10 to 10,000 femtoseconds and the beam has an energy of 10 nanojoules to 1 millijoule.~~

[[7. A method for laser induced breakdown (LIB) of a material being at least one member selected from the group consisting of biologic materials and transparent materials with a pulsed laser beam, the material being characterized by a relationship of fluence breakdown threshold versus laser pulse width that exhibits a rapid and distinct change in slope at a predetermined laser pulse width where the onset of plasma induced breakdown occurs, said method comprising the steps of:

a. generating a beam of one or more laser pulses in which each pulse has a pulse width equal to or less than said predetermined laser pulse width obtained by determining the ablation fluence (LIB) threshold of the material as a function of pulse width and by determining where the ablation (LIB) fluence threshold function is no longer proportional to the square root of pulse width and in which each pulse has a fluence greater than 5 joules per square centimeter to cause an ablation breakdown effect by itself; and

b. focusing said beam to a point at or beneath the surface of the material.

8. The method according to claim 1 wherein the laser pulse has an energy in a range of 10 nanojoules to 1 millijoule.

9. The method according to claim 1 wherein the laser pulse has a fluence in a range of 100 millijoules per square centimeter to 100 joules per square centimeter.

10. The method according to claim 1 wherein the laser pulse defines a spot in or on the material and the LIB causes ablation of an area having a size smaller than the area of the spot.

12. The method according to claim 1 wherein the pulse width is in a range of a few picoseconds to femtoseconds.

13. The method according to claim 1 wherein the breakdown includes changes caused by one or more of ionization, free electron multiplication, dielectric breakdown, plasma formation, and vaporization.

14. The method according to claim 1 wherein the breakdown includes plasma formation.

15. The method according to claim 1 wherein the breakdown includes disintegration.

16. The method according to claim 1 wherein the breakdown includes ablation.

17. The method according to claim 1 wherein the breakdown includes vaporization.

18. The method according to claim 1 wherein the spot size is varied by flexible diaphragm to a range of 1 to 100 microns.

19. The method according to claim 1 wherein a mask is placed in the path of the beam to block a portion of the beam to cause the beam to assume a desired geometric configuration.

20. The method according to claim 1 wherein the laser operating mode is non-TEMoo.

21. The method according to claim 1 wherein the laser pulse defines a spot and has a lateral gaussian profile characterized in that fluence at or near the center of the pulse spot is greater than the threshold fluence whereby the laser induced breakdown is ablation of an area within the spot.

22. The method according to claim 21 wherein the spot size is a diffraction limited spot size providing an ablation cavity having a diameter less than the fundamental wavelength size.

23. The method according to claim 1 wherein the characteristic pulse width is obtained by determining the ablation (LIB) threshold of the material as a function of pulse width and determining where the ablation (LIB) threshold function is no longer proportional to the square root of pulse width.

24. A method for laser induced breakdown of a material being at least one member selected from the group consisting of biologic materials and transparent materials which comprises:

a. generating a beam of one or more laser pulses in which each pulse has a pulse width equal to or less than a pulse width value corresponding to a change in slope of a curve of fluence breakdown threshold (Fth) as a function of laser pulse width (T), said change occurring at a point between first and second portions of said curve, said first portion spanning a range of relatively long pulse width where Fth varies with the square root of pulse width (T1/2) and said second portion spanning a range of short pulse width relative to said first portion with a Fth versus T slope which differs from that of said first portion, provided that at least one of the following two conditions applies: (i) each pulse has a fluence greater than predicted for a pulse by the slope of the first curve portion, to cause breakdown by itself; and (ii) each pulse has a fluence greater than predicted for a pulse by the second curve portion; and

b. directing said one or more pulses of said beam to a point at or beneath the surface of the material.

25. The method according to claim 24 and further including:

a. identifying a pulse width start point;

b. directing the laser beam initial start point at or beneath the surface of the material; and

c. scanning said beam along a predetermined path in a transverse direction.

26. The method according to claim 24 and further including:

a. identifying a pulse width start point;

b. directing the laser beam initial start point at or beneath the surface of the material; and

c. scanning said beam along a predetermined path in a longitudinal direction in the material to a depth smaller than the Rayleigh range.

27. The method according to claim 24 wherein the breakdown includes changes caused by one or more of ionization, free electron multiplication, dielectric breakdown, plasma formation, and vaporization.

28. The method according to claim 24 wherein the breakdown includes plasma formation.

29. The method according to claim 24 wherein the breakdown includes disintegration.

30. The method according to claim 24 wherein the breakdown includes ablation.

31. The method according to claim 24 wherein the breakdown includes vaporization.

32. The method according to any one of claims 1, 2, 5 or 24 wherein said beam is obtained by chirped-pulse amplification (CPA) means comprising means for generating a short optical pulse having a predetermined duration; means for stretching such optical pulse in time; means for amplifying such time-stretched optical pulse including solid state amplifying media; and means for recompressing such amplified pulse to its original duration.

33. A method for laser induced breakdown (LIB) of a non-organic material with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a predetermined laser pulse width where the onset of plasma induced breakdown occurs, said method comprising the steps of:

a. generating a laser pulse which has a pulse width equal to or less than said predetermined laser pulse width at a fluence to cause ablation by itself; and

b. directing said pulse to a point at or beneath the surface of the material so that the laser beam defines a spot and has a lateral gaussian profile characterized in that fluence at or near the center of the beam spot is greater than the threshold fluence whereby the laser induced breakdown is ablation of an area within the spot.

34. The method according to claim 33 wherein the spot size is a diffraction limited spot size providing an ablation cavity having a diameter less than the fundamental wavelength size.

35. A method for laser induced breakdown (LIB) of a non-biologic material with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a predetermined laser pulse width where the onset of plasma induced breakdown occurs, said method comprising the steps of:

a. generating a laser pulse which has a pulse width equal to or less than said predetermined laser pulse width; and

b. directing said pulse to a point at or beneath the surface of the material, the pulse width is l0 to 10,000 femtoseconds and the beam has an energy of 10 nanojoules to 1 millijoule and the pulse has a fluence to cause breakdown by itself

36. A method for laser induced breakdown (LIB) of a material by plasma formation with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a characteristic laser pulse width defining a first curve portion of relatively long pulse width and a second curve portion of relatively short pulse width, said method comprising the steps of:

a. generating one or more laser pulses which have a pulse width equal to or less than said characteristic laser pulse width, said characteristic pulse width being defined by the ablation (LIB) fluence threshold of the material as a function of pulse width where the ablation (LIB) fluence threshold function is no longer proportional to the square root of pulse width; provided that at least one of the following two conditions applies: each pulse has a fluence greater than predicted for a pulse by the slope of the first curve portion, to cause ablation by itself; and (ii) each pulse has a fluence greater than predicted for a pulse by the second curve portion; and

b. directing said pulse to a point at or beneath the surface of the material and inducing breakdown by plasma formation in the material.

37. A method for laser induced breakdown of a selected material which comprises:

a. determining, for the selected material, characteristic curve of fluence breakdown threshold (Fm) as a function of the square root of laser pulse width;

b. identifying a pulse width value on said curve corresponding to a distinct change in the relationship between the fluence breakdown and the square root of pulse width characteristic of said material;

c. generating a beam having a laser pulse having a pulse width at or below said pulse width value corresponding to said distinct change in slope and at a fluence to cause breakdown by itself; and

d. directing said pulse to a point at or beneath the surface of the material.

38. The method according to claim 37 and further including:

a. identifying a pulse width start point;

b. directing the laser beam initial start point at or beneath the surface of the material; and

c. scanning said beam along a predetermined path in a transverse direction.

39. The method according to claim 37 and further including:

a. identifying a pulse width start point;

b. directing the laser beam initial start point at or beneath the surface of the material; and

c. scanning said beam along a predetermined path in a longitudinal direction in the material to a depth smaller than the Rayleigh range.

40. The method according to claim 37 wherein the breakdown includes changes caused by one or more of ionization, free electron multiplication, dielectric breakdown, plasma formation, and vaporization.

41. The method according to claim 37 wherein the breakdown includes plasma formation.

42. A method for laser induced breakdown of a selected material which comprises:

a. determining, for the selected material, characteristic curve of fluence breakdown threshold (Fm) as a function of the square root of laser pulse width;

b. identifying a pulse width value on said curve corresponding to a distinct change in the relationship between the fluence breakdown and the square root of pulse width characteristic of said material;

c. generating a beam of one or more laser pulses, each of said pulses having a pulse width at or below said pulse with value corresponding to said distinct change in slope and at a fluence to cause breakdown by itself; and

d. directing said one or more pulses of said beam to a point at or beneath the surface of the material;

wherein the breakdown includes disintegration.

43. A method for laser induced breakdown of a selected material which comprises:

a. determining, for the selected material, characteristic curve of fluence breakdown threshold (Fth) as a function of the square root of laser pulse width;

b. identifying a pulse width value on said curve corresponding to a distinct change in the relationship between the fluence breakdown and the square root of pulse width characteristic of said material;

c. generating a beam of one or more laser pulses, each of said pulses having a pulse width at or below said pulse width value corresponding to said distinct change in slope and at a fluence to cause breakdown by itself; and

d. directing said one or more pulses of said beam to a point at or beneath the surface of the material;

wherein the breakdown includes ablation.

44. A method for laser induced breakdown of a selected material which comprises:

a. determining, for the selected material, characteristic curve of fluence breakdown threshold (Fth) as a function of the square root of laser pulse width;

b. identifying a pulse width value on said curve corresponding to a distinct change in the relationship between the fluence breakdown and the square root of pulse width characteristic of said material;

c. generating a beam of one or more laser pulses, each of said pulses having a pulse width at or below said pulse width value corresponding to said distinct change in slope and at a fluence to cause breakdown by itself and

d. directing said one or more pulses of said beam to a point at or beneath the surface of the material;

wherein the breakdown includes vaporization.

45. The method according to any one of claims 35, or 37 wherein said beam is obtained by chirped-pulse amplification (CPA) means comprising means for generating a short optical pulse having a predetermined duration; means for stretching such optical pulse in time; means for amplifying such time-stretched optical pulse including solid state amplifying media; and means for recompressing such amplified pulse to its original duration.

46. A method for laser induced breakdown (LIB) of a metallic material with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at

which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a characteristic laser pulse width, said method comprising the steps of:

generating a laser pulse which has a pulse width equal to or less than said characteristic laser pulse width, said pulse having a width between 10 and 10,000 femtoseconds, and the pulse has an energy of 1 nanojoule to 1 microjoule, and the pulse has a fluence to cause breakdown by itself; and

directing the pulse to a point at or beneath the surface of the material.

47. A method as in claim 46 wherein said beam is obtained by chirped pulse amplification (CPA) means comprising means for generating a short optical pulse having a predetermined duration;

means for stretching such optical pulse in time;

means for amplifying such stretched optical pulse including solid state amplifying media; and

means for recompressing such amplified pulse to its original duration.

48. A method for laser induced breakdown (LIB) of a material transparent to radiation with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a characteristic laser pulse width, said method comprising the steps of:

generating a laser pulse which has a pulse width equal to or less than said characteristic laser pulse width, where the laser pulse width is 10 to 10,000 femtoseconds and the laser pulse has an energy of 10 nanojoules to 1 millijoule, and the pulse has a fluence greater than 5 joules per square centimeter to cause breakdown by itself; and

directing the pulse to a point at or beneath the surface of the material.

49. A method as in claim 48 wherein said beam is obtained by chirped pulse amplification (CPA) means comprising means for generating a short optical pulse having a predetermined duration;

means for stretching such optical pulse in time;

means for amplifying such stretched optical pulse including solid state amplifying media; and

means for recompressing such amplified pulse to its original duration.

50. A method for laser induced breakdown (LIB) of a metal material with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus the square root of laser pulse width that exhibits a distinct change in slope at a characteristic laser pulse width;

determining the ablation (LIB) threshold of the material as a function of pulse width and determining where the ablation (LIB) threshold function is no longer proportional to the square root of pulse width;

generating a laser pulse which has a pulse width equal to or less than the characteristic pulse width at a fluence to cause ablation by itself; and

directing the pulse to a point at or beneath the surface of the material.

51. A method of optimally selecting a pulse width and fluence for a pulsed laser beam such that the pulsed laser induces laser induced breakdown (LIB) of a material being at least one member selected from the group consisting of biologic materials and transparent materials, the material being characterized by a relationship curve of fluence threshold at which breakdown occurs versus the square root of laser pulse width comprising the step of identifying where the relationship between flence threshold and the square root of pulse width exhibits a distinct change in slope defining a first curve portion of relatively long pulse width and a second curve portion of relatively short pulse width and selecting the pulse width associated with the distinct change in slope and selecting a fluence level according to at least one of the following two conditions: (i) the fluence is greater than predicted for a pulse by the slope of the first curve portion, to cause ablation by itself; and (ii) the fluence is greater than predicted for a pulse by the second curve portion; and directing the pulse at a point at or beneath the surface of the material.

52. A method of optimally selecting a pulse width and fluence for a pulsed laser beam such that the pulsed laser induces laser induced breakdown (LIB) of a non-organic material, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus the square root of laser pulse width comprising the step of

identifying where the relationship between fluence threshold and the square root of pulse width exhibits a distinct change in slope and selecting the pulse width associated with the distinct change in slope and a fluence level for a pulse by itself to cause breakdown and the wavelength is 800 nanometers to 2 microns, and directing the pulse at a point at or beneath the surface of the material.

53. A method of optimally selecting a pulse width and fluence for a pulsed laser beam such that the pulsed laser induces laser induced breakdown (LIB) of a material being at least one member selected from the group consisting of biologic materials and transparent materials, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus the square root of laser pulse width comprising the step of identifying where the relationship between fluence threshold and the square root of pulse width exhibits a distinct change in slope and a fluence level greater than 5 joules per square centimeter for a pulse by itself to cause breakdown; and directing the pulse at a point at or beneath the surface of the material.

54. A method for laser induced breakdown of a material with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus the square root of laser pulse width that exhibits a distinct change in slope at a characteristic pulse width, said method comprising the steps of:

selecting a pulse width which is equal to or less than the distinct change in slope;

generating a laser pulse which has a pulse width equal to or less than the characteristic laser pulse width at a fluence to cause a breakdown effect by itself, provided that when said material is biologic said fluence is greater than 5 joules per square centimeter; and when said material is non-biologic said wavelength is 800 nanometers to 2 microns; and

directing said pulse to as point at or beneath the surface of a material.

55. A method for laser induced breakdown (LIB) of a material being at least one member selected from the group consisting of biologic materials and transparent materials with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a characteristic laser pulse width, said method comprising the steps of:

a. generating laser pulses, each of which has a pulse width equal to or less than said characteristic laser pulse width at a fluence greater than 5 joules per square centimeter by itself to cause a breakdown effect at respective coordinates;

b. directing said pulses to the material; characterized in that said breakdown effect is ablation reproduced at each of the respective coordinates by a respective one of said laser pulses.

56. A method for laser induced breakdown (LIB) of a material with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a characteristic laser pulse width, said method comprising:

a. generating a laser pulse which has a pulse width equal to or less than said characteristic laser pulse width at a fluence to cause a breakdown effect with a single laser pulse, provided that when said material is biologic said fluence is greater than 5 joules per square centimeter; and when said material is non-biologic said wavelength is 800 nanometers to Z microns; and

b. directing said pulse to a point at or beneath the surface of the material.

57. The method of claim 56 wherein a plurality of pulses are generated each of which causes a breakdown effect.

58. The method of claim 57 wherein a respective one of said plurality of said pulses is directed at a respective coordinate.

59. A method for laser induced breakdown (LIB) of a material being at least one member selected from the group consisting of biologic materials and transparent materials with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus the square root of laser pulse width that exhibits a distinct change in slope at a characteristic pulse width, said method comprising:

selecting a pulse width which is equal to or less than the distinct change in slope and selecting a fluence greater than 5 joules per square centimeter to cause a breakdown effect with a single laser pulse;

generating a laser pulse which has the selected pulse width and the selected fluence; and

directing said pulse to a point at or beneath the surface of a material;

characterized in that said breakdown effect is reproducible at respective coordinates by a respective said laser pulse having the selected pulse width and fluence.

60. The method of claim 59 wherein a plurality of pulses are generated each of which causes a breakdown effect.

61. The method of claim 60 wherein a respective one of said plurality of said pulses is directed at a respective one of said respective coordinates.

62. A method for laser induced breakdown (LIB) of a material with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a characteristic laser pulse width defining a first curve portion of relatively long pulse width and a second curve portion of relatively short pulse width, said method comprising:

a. generating a laser pulse which has a pulse width equal to or less than said characteristic laser pulse width at a fluence according to at least one of the following conditions: (i) the fluence is greater than predicted for a pulse by the slope of the first curve portion, to cause ablation by itself; and (ii) the fluence is greater than predicted for a pulse by the second curve portion; and

b. directing said pulse to a point at or beneath the surface of the material; characterized in that said breakdown effect is reproducible at respective coordinates by a respective said laser pulse.

63. The method of claim 62 wherein a plurality of pulses are generated each of which causes a breakdown effect.

64. The method of claim 63 wherein a respective one of said plurality of said pulses is directed at a respective one of said respective coordinates.]]

65. (Previously presented) <u>A method of ablating or changing properties in structure of an opaque or a transparent material by laser induced breakdown with a pulsed laser beam, said method comprising the steps of:</u>

generating a beam of one or more laser pulses characterized by a pulse width approximately equal to or less than a pulse width at which laser induced breakdown becomes essentially accurate at a corresponding fluence, wherein each laser pulse with has a fluence to cause breakdown itself;

configuring the beam such that a first area within a spot size of the beam exceeds a breakdown threshold and such that a second area within the spot size does not exceed the breakdown threshold;

directing said beam to the opaque or transparent material; and

scanning the beam along a predetermined path beneath the surface of the opaque or transparent material to induce laser induced breakdown therein to a depth smaller than the Rayleigh range,

said essentially accurate breakdown being determinable by a distinct change in breakdown threshold accuracy.

66. (Previously presented) A method of ablation or changing a structural property of an opaque or a transparent material by laser induced breakdown, the opaque or transparent material being characterized by a relationship of fluence breakdown threshold versus laser pulse width that exhibits a distinct change in slope at a characteristic pulse width, the method comprising the steps of:

generating a pulsed laser beam comprising a pulse having a pulse width equal to or less than the characteristic pulse width;

configuring the pulsed laser beam such that a first area within a spot size of the pulsed laser beam exceeds the fluence breakdown threshold and such that a second area within the spot size does not exceed the fluence breakdown threshold, wherein the pulse has a fluence to cause breakdown itself;

directing the pulsed laser beam to the opaque or transparent material; and

scanning the beam along a predetermined path beneath the surface of the opaque or transparent material to induce laser induced breakdown therein to a depth smaller than the Rayleigh range.

67. (Previously presented) A method of ablation or changing properties in structure of an opaque or a transparent material with a pulsed laser beam comprising:

generating the pulsed laser beam characterized by a pulse width at a corresponding fluence characterized by a relationship of fluence breakdown threshold versus laser pulse width having a distinct change in slope, having at least one pulse with a pulse width sufficiently short that the size of the feature created in the opaque or transparent material is not substantially limited by thermal diffusion in the opaque or transparent material;

configuring an intensity profile of the pulsed laser beam such that a first area within a spot size of the pulsed laser beam exceeds a breakdown threshold and such that a second area within the spot size does not exceed the breakdown threshold, wherein the at least one pulse has a fluence to cause breakdown itself;

directing said beam to the opaque or transparent material; and

scanning the beam along a predetermined path beneath the surface of the opaque or transparent material to induce laser induced breakdown therein to a depth smaller than the Rayleigh range.

68. (Previously presented) A method of ablation or changing properties in structure of an opaque or a transparent material characterized by a thermal diffusivity, D, with a pulsed laser beam having a pulse width, T, characterized by a pulse width with a relationship of fluence breakdown threshold versus laser pulse width having a distinct change in slope, said method comprising the steps of:

generating the pulsed laser beam with one or more laser pulses having a pulse width sufficiently short at a corresponding fluence so that the thermal diffusion length 1th=Dt1/2 in the opaque or transparent material is significantly smaller than the absorption depth (1/a), where a is the absorption coefficient for the radiation;

configuring the pulsed laser beam such that a first area within a spot size of the pulsed laser beam exceeds the fluence breakdown threshold and such that a second area within the spot size does not exceed the fluence breakdown threshold, wherein each laser pulse with has a fluence to cause breakdown itself;

directing said beam to the opaque or transparent material; and

scanning the beam along a predetermined path beneath the surface of the opaque or transparent material to induce laser induced breakdown therein to a depth smaller than the Rayleigh range.

69. (Previously presented) A method of ablation or changing properties in structure of an opaque or a transparent material characterized by a relationship of fluence breakdown threshold versus laser pulse width in which the fluence breakdown threshold is nearly constant over a pulse width range, the method comprising the steps of:

generating a beam having at least one pulse with a pulse width within the pulse width range;

configuring the beam such that a first area within a spot size of the beam exceeds the fluence breakdown threshold and such that a second area within the spot size does not exceed the fluence breakdown threshold, wherein the at least one pulse has a fluence to cause breakdown itself;

directing said beam to the opaque or transparent material; and

scanning the beam along a predetermined path beneath the surface of the opaque or transparent material to induce laser induced breakdown therein to a depth smaller than the Rayleigh range.

70. (Previously presented) The method according to any of claims 65-69 wherein the opaque or transparent material comprises an integrated circuit material.

71. (Previously presented) The method according to claim 70 wherein the opaque or transparent material comprises at least two layers and laser induced breakdown substantially affects one layer and not the other.

72. (Previously presented) The method of claim 71 wherein the opaque or transparent material comprises a layer of metal on glass and laser induced breakdown is induced in the layer of metal.

73. (Previously presented) The method of any of claims 65-69 wherein laser induced breakdown is induced beneath the surface of the opaque or transparent material.

74. (Previously presented) The method of any of claims 65-69 comprising irreversibly changing a property of the opaque or transparent material.

75. (Previously presented) The method of claim 74 in which the step of irreversibly changing includes one or more of melting and vaporization.

76. (Previously presented) The method of claim 73 comprising irreversibly changing a property of the opaque or transparent material.

77. (Previously presented) The method of claim 76 in which the step of irreversibly changing includes one or more of melting and vaporization.

78. (Previously presented) The method of claim 73 in which laser induced breakdown causes thermal-physical changes in state leading to an irreversible change in the opaque or transparent material.

79. (Previously presented) The method of claim 78 in which the thermal-physical changes in state include one or more of melting and vaporization.

80. (Previously presented) The method of any of claims 65-69 in which laser induced breakdown includes changes caused by one or more of ionization, free electron multiplication, dielectric breakdown, plasma formation, and vaporization.

81. (Previously presented) The method according to any of claims 65-69 comprising generating a short optical pulse having a predetermined duration; stretching such optical pulse in time; amplifying such time-stretched optical pulse, and recompressing such amplified pulse to a pulse width.

82. (Previously presented) The method according to any of claims 65-69 comprising scanning the beam along a predetermined path along the surface of the opaque or transparent material.

83. (Previously presented) The method according to any of claims 65-69 comprising scanning the beam along a predetermined path beneath the surface of the opaque or transparent material.

84. (Previously presented) The method according to any of claims 65-69 comprising laser induced breakdown of a material used in one of micromachining, integrated circuit manufacture and encoding data in data storage media.

85. (Previously presented) The method according to any of claims 65-69 comprising laser induced breakdown in a spot without adversely affecting peripheral areas adjacent to the spot.

86. (Previously presented) The method according to any of claims 65-69 wherein the beam comprises one or more pulses with pulse width in the range of 10 femtoseconds to 10 picoseconds.

87. (Previously presented) The method according to any of claims 65-69 wherein the beam comprises one or more pulses with pulse energy in the range of 1 picojoule to 1 joule.

88. (Previously presented) The method according to any of claims 65-69 wherein the repetition rate of the beam is between one pulse per second and 100 million pulses per second.

89. (Previously presented) The method according to any of claims 65-69 wherein the beam comprises one or more pulses with a central wavelength selected from at least one of the following ranges: 100 nm to 200 nm, 200 nm to 300 nm, 300 nm to 700 nm, 700 nm to 1000 nm, 1000 nm to 1100 nm, 1100 nm to 1400 nm, 1400 nm to 1600 nm, 1600 nm to 2000 nm.

90. (Previously presented) The method according to claim 69 wherein the beam comprises one or more pulses, each having a pulse width in the range of 10 femtoseconds to 10 picoseconds.

91. (Previously presented) The method according to claim 69 wherein the beam comprises one or more pulses, each having a pulse energy in the range of 1 picojoule to 1 joule.

92. (Previously presented) The method according to claim 69 wherein the repetition rate of the beam is between one pulse per second and 100 million pulses per second.

93. (Previously presented) The method according to claim 69 wherein the beam comprises one or more pulses with a central wavelength selected from at least one of the following ranges: 100 nm to 200 nm, 200 nm to 300 nm, 300 nm to 700 nm, 700 nm to 1000 nm, 1000 nm to 1100 nm, 1100 nm to 1400 nm, 1400 nm to 1600 nm, 1600 nm to 2000 nm.

94. (Previously presented) A method for laser induced breakdown of an opaque or transparent material with a pulsed laser beam, the material being characterized by a relationship of fluence threshold at which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a characteristic laser pulse width, said method comprising the steps of:

generating at least one laser pulse which has a pulse width equal to or less than said characteristic laser pulse width at a corresponding fluence;

configuring the pulsed laser beam such that a first area within a spot size of the pulsed laser beam exceeds the fluence threshold and such that a second area within the spot size does not exceed the fluence threshold, wherein the at least one laser pulse has a fluence to cause breakdown itself;

directing said pulse to a point at or beneath the surface of the opaque or transparent material; and

scanning the beam along a predetermined path beneath the surface of the material to induce laser induced breakdown therein to a depth smaller than the Rayleigh range.

95. (Previously presented) A method for laser induced breakdown of a metal layer on a glass substrate with a pulsed laser beam, the metal being characterized by a relationship of fluence threshold at which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a characteristic laser pulse width, said method comprising the steps of:

generating at least one laser pulse which has a pulse width equal to or less than said characteristic laser pulse width;

configuring the pulsed laser beam such that a first area within a spot size of the pulsed laser beam exceeds the fluence threshold and such that a second area within the spot size does not exceed the fluence threshold, wherein the at least one pulse has a fluence to cause breakdown itself;

directing said pulse to a point at or beneath the surface of the metal; and

scanning the beam along a predetermined path beneath the surface of the metal layer to induce laser induced breakdown therein to a depth smaller than the Rayleigh range.

96. (Previously presented) A method for laser induced breakdown of a first layer of an opaque or a transparent material adjacent a second layer of the opaque or transparent material with a pulsed laser beam, without substantially affecting the second layer, the first layer being characterized by a relationship of fluence threshold at which breakdown occurs versus laser pulse width that exhibits a distinct change in slope at a characteristic laser pulse width, said method comprising the steps of:

generating at least one laser pulse which has a pulse width equal to or less than said characteristic laser pulse width;

configuring the pulsed laser beam such that a first area within a spot size of the pulsed laser beam exceeds the fluence threshold and such that a second area within the spot size does not exceed the fluence threshold, wherein the at least one pulse has a fluence to cause breakdown itself;

directing said pulse to a point at or beneath the surface of the first layer; and

scanning the beam along a predetermined path beneath the surface of the opaque or transparent material to induce laser induced breakdown therein to a depth smaller than the Rayleigh range.

97. (Previously presented) The method according to any of claims 65-69, 94, and 96, wherein the transparent material is glass.

98. (Previously presented) The method according to claim 65, wherein the opaque or transparent material is a metal.

99. (Previously presented) The method according to claim 66, wherein the opaque or transparent material is a metal.

100. (Previously presented) The method according to claim 67, wherein the opaque or transparent material is a metal.

101. (Previously presented) The method according to claim 68, wherein the opaque or transparent material is a metal.

102. (Previously presented) The method according to claim 69, wherein the opaque or transparent material is a metal.

103. (Previously presented) The method according to claim 94, wherein the opaque or transparent material is a metal.

104. (Previously presented) The method according to claim 96, wherein the opaque or transparent material is a metal.